MATH 413 SYLLABUS Modern Applied Mathematics I – Prof. Sachs– Fall 2006

TEXT: Introduction to Applied Mathematics by G. Strang (Cambridge-Wellesley Press).

COURSE OVERVIEW: The main goals of this course are to introduce the basic ideas of applied mathematics, including the creation of models, the analysis of models, use of numerical simulation, and refinement of models based on the previous parts. Depending on student interest, we will consider some particular applications. Applications are numerous and growing, and include data compression, voice recognition, image processing, internet routing and web streaming, financial analysis, the human genome project, encryption, along with more traditional areas of physics, engineering, chemistry, and computational tools. Students will work individually or in groups and present results of projects along with traditional homework and exams. Outside speakers may introduce current work.

MEETING: Monday and Wednesday, 3:00-4:15pm, Sci. & Tech. I, rm 242.

OFFICE HOURS: Mon. and Wed., 4:30-5:45pm, Sci. & Tech I, rm 201D, and by appt.

CONTACT INFO: OFFICE PHONE: 993-1464 E-MAIL: rsachs@gmu.edu

COURSE WEB PAGE: math.gmu.edu/ rsachs/math413

GRADING: Grading will be fair and impartial. Points used as the basis of the grade will be: Hmwk. (100 pts.); Class (20 pts.); projects (50 pts.); Exams (200 pts.); Final exam (150 pts.).

POLICIES: The GMU Honor code is in effect at all times and students are expected to be fully aware of its requirements. Group work may be part of the course, in which case group members will truthfully report on non-contributing members. Absence from quizzes and exams must be for a valid reason and requires prior notification except in extreme circumstances. DO NOT ARRANGE TO LEAVE BEFORE THE FINAL EXAM.

IMPORTANT DATES: Last day to drop, no tuition liability Sept. 12
Last day to drop without dean's signature Sept. 29, 5pm

EXAMS: Exam 1 **Tentative** Monday, Sept. 25
Exam 2 **Tentative** Monday, Oct. 30
Final Exam **Definitely** Monday, Dec. 18, 1:30pm-4:15pm

(over)

MATERIAL COVERED AND TENTATIVE WEEKLY SCHEDULE

Overview of course; quick review of calculus, matrix algebra, differential equations

Deeper linear algebra: special structures and connections with multivariable calculus

Least squares revisited and minimum principles; some basic systems of equilibrium

Variational prinicples for equilibrium models

Electrical Networks and Equilibrium of Structures

1-D Continuum model for electrical and mechanical equilibrium

Functions as vectors in an inner product space; introductory calculus of variations

Bending of beams; higher dimensional models

Inner products and boundary terms in higher dimensions; vector calculus theorems reviewed; Laplace's equation in 2-D and 3-D

Introduction to finite elements

General set-up; equations of solids and fluids

Introduction to Fourier series

Discrete Fourier series

Fourier Transforms

Along the way, we will discuss scaling and dimension, singular vs. regular perturbations, and use Matlab PDEtoolbox to do calculations and simulations.